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PAPER

'I bet you know more and are nicer too!': what children infer from others' accuracy

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Abstract

Research has shown that preschoolers monitor others' prior accuracy and prefer to learn from individuals who have the best track record. We investigated the scope of preschoolers' attributions based on an individual's prior accuracy. Experiment 1 revealed that 5-year-olds (but not 4-year-olds) used an individual's prior accuracy at labelling to predict her knowledge of words and broader facts; they also showed a 'halo effect' predicting she would be more prosocial. Experiment 2 confirmed that, overall, 4-year-olds did not make explicit generalizations of knowledge. These findings suggest that an individual's prior accuracy influences older preschoolers' expectations of that individual's broader knowledge as well as their impressions of how she will behave in social interactions.

Introduction

The ability to appreciate what other people know, or are likely to know, is essential in our social lives. It is at the heart of many social interactions, enabling us to understand, anticipate, and influence the actions of others. Judgments of what others know can also affect our perception of their personality and influence our decisions on how to interact with them. Understanding the early development of knowledge assessment is therefore an essential step in the investigation of children's nascent social reasoning.

Knowledge assessment is especially important for interpersonal learning. Much of what children learn about the world they learn from others. Importantly, though, children are not passive sponges absorbing any information; rather, they are selective in their learning. Early social-cognitive skills that allow children to reason about others' knowledge undoubtedly aid their learning from others.

Sensitivity to others' accuracy appears to emerge quite early. For instance, 16-month-olds look longer at a speaker who mislabels common objects (Koenig & Echols, 2003) and 14-month-olds prefer to follow the gaze of a person who previously displayed 'accurate' emotional reactions, displaying excitement about containers with toys inside rather than empty containers (Chow, Poulin-Dubois & Lewis, 2008). Furthermore, a host of new findings on children's early learning suggest that preschoolers profitably use their sensitivity to others' track record of accuracy in various learning situations. In this research, preschoolers are typically presented with two informants, one who accurately labels familiar objects (e.g. a ball) and the other who mislabels the same objects. Afterwards, children prefer to learn *new* object labels from the previously accurate informant (e.g. Koenig, Clement & Harris, 2004). This finding has been replicated across different task variants and appears quite robust (Birch, Vauthier & Bloom, 2008; Corriveau & Harris, 2009; DiYanni & Kelemen, 2008; Jaswal & Neely, 2006; Koenig, Clément & Harris, 2004; Koenig & Harris, 2005; Scofield & Behrend, 2008).

Our aim with the present studies was to assess the *scope* of children's attributions, delineating how broadly past accuracy influences children's subsequent expectations of individuals. Here, we asked preschoolers to make explicit predictions about what those individuals would know, as well as other characteristics (e.g. prosocial tendencies, talents). While young children are less likely to make trait-like attributions than those in mid-childhood (e.g. Kalish, 2002; Rholes & Ruble, 1984), there is research showing that even preschoolers can predict individuals' future behaviour based on stable psychological attributes from past behaviour (e.g. Boseovski & Lee, 2006; Gopnik, 2007; Heyman & Gelman, 1999; Heyman, Gee & Giles, 2003; Yuill, 1997).

The scope of children's knowledge attributions based on one's history of accuracy could be very narrow, very broad, or somewhere in between. There is some research suggesting that by age 3 or 4 children may generalize a speaker's past knowledge in one domain (words for

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objects) to another, closely related domain (functions for objects) (Koenig & Harris, 2005) and vice versa (Birch, Luca, Frampton, Vauthier & Bloom, 2005). However, no research to date has examined whether children make such generalizations explicitly, outside of a learning context, or how an individual's prior accuracy influences children's predictions about *other* characteristics of that person. Being knowledgeable is a desirable attribute, and the perceived presence or absence of such an attribute may bias one's expectations of that individual's other attributes.

Indeed, a large body of literature has shown that people tend to have more positive expectations towards those who possess other desirable attributes. If someone possesses one positive quality, people are inclined to attribute other positive attributes to that individual if they have little other information to go on. The aspect of this 'halo effect' that has been most studied is positive prejudice towards attractive individuals, an effect that has been observed quite reliably in adults (e.g. Dion, Berscheid & Walster, 1972), school-age children (e.g. Rumsey, Bull & Gahagan, 1986), and preschoolers (e.g. Dion, 1973; Ramsey & Langlois, 2002). Other traits can also cause a halo effect. For example, adults' perception of the attractiveness of a target is influenced by that target's personality (Gross & Crofton, 1977) and teenagers' perception of attractiveness is also influenced by perceptions of ability (Felson & Bohrnstedt, 1979). Young children also express more liking towards lucky than unlucky individuals (Olson, Banaji, Dweck & Spelke, 2006): although in this case they are not explicitly attributing other positive characteristics to the lucky individuals, they are still biased in their evaluations of these individuals by the valence of the events associated with them. A few studies have even shown generalizations from positive or negative *psychological* attributes to other valued traits in 4- and 5-year-olds (e.g. Nabors & Keyes, 1995; Nowicki, 2006). For instance, preschoolers who heard about characters who displayed consistent moral goodness (or 'evilness') predicted not only that 'good' characters would be more likely than 'evil' ones to display future prosocial behaviour, but also expected greater intellectual and athletic ability in the 'good' character (Cain, Heyman & Walker, 1997). Such generalization across traits in kindergarteners was also found in studies by Benenson and Dweck (1986) and Stipek and Daniels (1990).

The current studies assessed (a) whether children interpret prior accuracy as indicative of trait-like knowledge; that is, whether they infer that an individual's prior accuracy in one domain is indicative of their knowledge more broadly, and (b) whether children show a 'halo effect' from one's prior accuracy, attributing other positive characteristics (e.g. prosocial behaviour) more to an individual who was previously accurate than to an individual who was previously inaccurate. Specifically, Experiment 1 assessed the scope of 4- and 5-year-olds' attributions and impressions following a brief history of accuracy or inaccuracy in labelling common objects. We wondered whether children treat this information as only informative about what the other person likely knows about certain kinds of words, or do they suspect, for instance, that it should generalize, at least somewhat, to knowledge about other things such as knowledge of broader facts (e.g. whether this person knows a lot about stars and planets)? Furthermore, does one's past accuracy only influence children's impressions of others' knowledge, or does it extend to other evaluative judgments? To address these questions, children were asked questions from six categories: Word Knowledge, Fact Knowledge, Prosocial–Antisocial Behaviour, Talents, and two sets of control questions. To ensure that children were not forced to select between the two informants, the children were given four different response options for all the questions, namely each individual informant, both or neither.

Experiment 1

Method

Participants

Fifty children participated in Experiment 1. Data from one participant were not included in the analyses because he failed to remember which informant was accurate. Thus, analyses included data from the remaining 49 participants: 24 4-year-olds (*M* age = 4,6; age range = 3,11–5,0; 14 males) and 25 5-year-olds (*M* age = 5,4; age range = 5,1–5,10; 12 males).

Materials

Two child-like female hand puppets ('Charlotte' and 'Lucy') served as informants in the *History Phase*. In the *Test Phase*, children were presented with a picture divided into quadrants. In two of the quadrants, there were pictures of each of the puppets individually; in the third quadrant was a picture of both puppets; and the fourth was blank. Two versions of all questions were constructed such that each question was presented positively (e.g. 'Who has a cat?') in one version (Version A), and negatively (e.g. 'Who doesn't have a cat?') in the other version (Version B). Both versions included two positive and two negative items in each category.

Procedure

Children were first introduced to the two puppets. In the *History Phase*, each puppet was presented with the four familiar objects. One of them accurately labelled the four objects, and the other inaccurately labelled the objects (e.g. calling the ball ‘a book’).[1] Before proceeding with the *Test Phase*, children were asked to state the four familiar object labels and to remember which puppet was accurate. One child who failed this question was excluded from the analyses.

Then, in the *Test Phase*, children were asked to ‘guess some things’ about the puppets. In a warm-up phase, the experimenter demonstrated how to use the response sheet with items relating to the puppets’ appearance (e.g. ‘Who has red shoes?’). She explained that, if the answer to the question is only Charlotte, to point to Charlotte’s picture, and so on for Lucy, both and neither. One demonstration was given for the one-puppet quadrants, and two for the ‘both’ and ‘none’ quadrants because these were expected to be harder for children to grasp. Any mistakes children made during these demonstration questions were corrected with feedback.

Participants were then administered 24 questions from six categories: knowledge of words (e.g. Who knows words for lots of different machines?), knowledge of facts (e.g. Who knows that cats can see at night?), talents (e.g. Who can draw pretty pictures?), prosocial–antisocial behaviour (e.g. Who always shares her toys?), and two sets of control items (preferences and possessions, and situation-specific knowledge). The category of ‘situation-specific knowledge’ was included because these questions (e.g. Who knows where I put my books?) included the word ‘know’ just like the ‘word knowledge’ and ‘fact knowledge’ questions. If children only paid attention to the superficial wording of the questions, there should be no difference in performance between these categories. However, situation-specific knowledge should not be person-dependent; that is, situation-specific knowledge pertains to knowledge *states* rather than knowledge as a *trait*: whether or not someone is knowledgeable in general about object labels does not predict whether that person is *currently informed* about, for example, the location of the experimenter’s books. Consequently, we expected that children would not ascribe situation-specific knowledge based on one’s history of accuracy. The second set of control questions, preferences and possessions, are non-evaluative in nature (e.g. whether someone does or does not have a cat is generally thought to be neither particularly positive nor negative) and furthermore should also be unrelated to one’s prior accuracy, thus children should be at chance for this category as well.

[1] For practical reasons, all participants were administered a short (approximately 8 minutes in duration) experiment between the *History Phase* and *Test Phase* of the current experiment. Twenty-eight children participated in one version of the intervening experiment and the remaining 21 participated in another version of the experiment. Importantly, there were no differences in performance between children who were administered the two variants of the intervening procedure, $F(1, 47) = .01$, $p = .909$, *ns*. We do not believe that these intervening procedures affected the results of the current experiment. Importantly, the intervening procedures did not contain information pertaining to the informants’ accuracy or credibility (the variable manipulated in Experiment 1). If anything, one might expect that the intervening information could have diminished the strength of the explicit attributions children made, given the delay between the information about the informants’ prior accuracy (the History Phase) and the explicit judgment questions administered during the Test Phase. We acknowledge this as a possibility though we note that only children who correctly remembered which of the two informants was previously accurate were included in the analyses and that Experiment 2 removed the intervening procedures.

Results

All items of positive valence were scored as +1 when attributed to the previously accurate puppet and as −1 when attributed to the previously inaccurate puppet, and vice versa for items of negative valence. Items attributed to both or neither puppet scored as 0. Thus, a score between −4 and 4 was calculated for each of the six categories.

Preliminary analyses ruled out any effects of the participant’s gender (male or female), order of accurate puppet (first puppet or second puppet), version of the list of questions (Version A or B), or version of intervening experiment, but revealed a main effect of age. This variable was therefore kept in the main analysis. A 6 (category) × 2 (age) mixed-design ANOVA was performed, and revealed main effects of category, $F(5, 235) = 2.38$, $p = .047$, and age, $F(1, 47) = 4.44$, $p = .041$, but no significant interaction between age and category, $F(5, 235) = 1.70$, $p = .135$, *ns*.

Planned one-sample *t*-tests were conducted comparing each category to chance (0 on a scale between −4 and 4). These comparisons were done separately with 4- and 5-year-olds given the significant age effect. For 4-year-olds, none of the categories differed from chance (all *p*s > .25); 5-year-olds were more likely to attribute word knowledge ($t(24) = 3.73$, $p = .001$), fact knowledge ($t(24) = 3.13$, $p = .005$) and prosocial behaviour ($t(24) = 3.54$, $p = .002$) to the previously accurate puppet, but not talents ($t(24) = 1.92$, $p = .067$, *ns*), and as expected neither distracter category (situation-specific knowledge: $t(24) = 1.80$, $p = .085$, *ns*; preferences and possessions: $t(24) = 0.80$, $p = .434$, *ns*). (See Figure 1.)

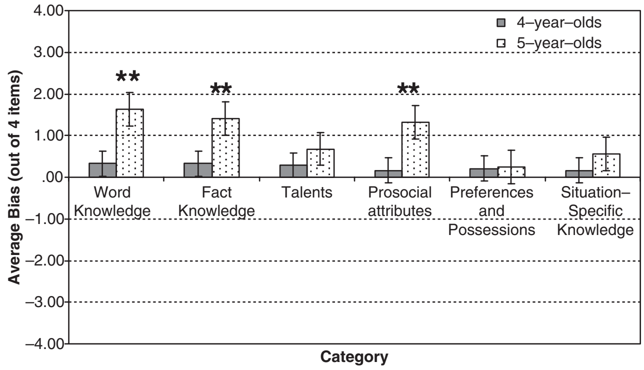

Figure 1 *Experiment 1 results.*

Discussion

Data from Experiment 1 suggest that 4- and 5-year-olds hold different expectations about individuals' knowledge and behaviour based on one's history of accuracy or inaccuracy. While there is no evidence that 4-year-olds used past accuracy for explicit predictions of the individuals' future behaviour, 5-year-olds expected a knowledgeable informant to continue to be knowledgeable in more than one domain, and were even influenced in their predictions of that individual's prosocial and antisocial dispositions.

Even though 5-year-olds were influenced by the informants' past accuracy in their attributions, they were, however, still somewhat conservative in their generalizations: the category that revealed the highest ratings was word knowledge (the same domain in which the informants had demonstrated their prior accuracy) with an average of 1.58 on a scale from −4 to 4 (where 0 equals chance). While notably well below ceiling, the estimated effects sizes for word knowledge (d = .75), fact knowledge (d = .63), and prosocial–antisocial behaviour (d = .71) were all medium-to-large in magnitude. It is interesting to note, actually, that had the mean scores been very close to 4, we might have been concerned that children were either putting too much weight on past accuracy or were particularly good at picking up on demand characteristics of the experiment. After all, even adults would acknowledge that prior accuracy is only a partially useful indication of future knowledge and is by no means a perfect indicator. It is possible that children's low mean ratings reflect a tacit awareness of the fact that prior accuracy is at best only a partial indicator of future knowledge.

The age effect found in this experiment is fairly consistent with the literature on trait attribution in childhood where, in general, younger children are less prone to predict stability of behaviour across time and situations. Although young children generally tend to make few stable trait attributions, there is research suggesting that 4-year-olds can develop behavioural expectations in some paradigms, especially when multiple instances of consistent behaviour are provided (e.g. Boseovski & Lee, 2006; Gopnik, 2007). Thus, it is unclear why the 4-year-olds did not reveal broader expectations about the informants in this study. One may wonder whether it could be due to memory demands; however, we believe this is unlikely given that all children included in the analyses remembered which informant was previously accurate before answering the questions (i.e. only one child's data were excluded for failure to remember). There are, however, several other plausible explanations for these results. It is possible that the processing demands of the present paradigm were simply too great for the younger children. For example, this experiment required using a response sheet that may have been confusing for younger children – indeed, casual observation by the experimenter suggests that many of the younger children seemed fascinated by the blank square (representing the 'neither/nobody' response option), as if this was especially unusual to them. Alternatively, and perhaps more interestingly, younger children may be more reserved in their judgments of others and refrain from forming such broad impressions in the absence of more convincing evidence.

Nonetheless, given that the 4-year-olds' mean scores are positive (albeit very close to 0) in all categories, a very weak effect may be present but too small to be captured statistically in the present paradigm. The estimated effect sizes for all non-distracter categories for 4-year-olds vary between a Cohen's d of .12 and .21: some of these effects appear negligible, but, in some categories (i.e. word knowledge, fact knowledge and talents all yield ds between .19 and .21) a real albeit small effect may be present.

To investigate the cause of the lack of generalization displayed by 4-year-olds in Experiment 1, Experiment 2 presented a sample of 4-year-olds with a simplified version of the paradigm of Experiment 1. The number of items in the *Test Phase* was reduced by half, and children were asked to choose between the two puppets by pointing directly to the puppets, rather than being given four options on a response sheet. Although using a paradigm that is not forced-choice has many benefits and yields results that are potentially more naturalistic and indicative of their spontaneous attributions, here we wanted to know whether 4-year-olds could make explicit judgments about their informants' knowledge more broadly if the task were simplified and they were essentially 'forced' to choose between the two informants.

Experiment 2

Method

Participants

Twenty-two 4-year-olds participated in Experiment 2. Data from four children were not included in the analyses because they failed to remember which informant was accurate at the end of the experiment. The final sample therefore comprised 18 children (M age = 4,6; age range = 3,10–5,1; nine males).

Materials

The materials were the same as Experiment 1 except that the four-quadrant response sheet was not used and fewer questions were used.

Procedure

The *History Phase* was identical to Experiment 1. After the *History Phase*, children were asked to 'guess some things' about the puppets. The experimenter placed the puppets in front of the child and told the child to point to one of the puppets in response to the questions. The experimenter then asked four warm-up questions relating to the puppets' physical appearance (e.g. 'Who has blue eyes?'). Two of the warm-up questions were positive and two were negative. Children were provided with feedback if they answered any of these four questions incorrectly.

Participants were then administered 12 questions from the same six categories as in Experiment 1. The 12 questions were presented in two different pre-established pseudo-random orders, and for each order two versions were created so that each item was presented positively in one version and negatively in the other version. There were therefore four different list versions in total. All versions included one positive and one negative item in each category.

At the end, children were asked to state the four familiar object labels, and to remember which puppet was accurate at the beginning of the experiment. Children failing this question ($n = 4$) were excluded from the analyses.

Results

A score of 1 was given for each positive item attributed to the previously accurate puppet and negative item attributed to the previously inaccurate puppet, and a score of 0 for the opposite response pattern. The scores were then totalled within each category, resulting in a score between 0 and 2 for each category. One-sample *t*-tests did not reveal any difference between any of the categories and chance (1⁄2); all *p*s > .25. (See Figure 2.)

The experimenter noted, however, that this time a large proportion of the children responded by consistently alternating between the two puppets (e.g. pointing to 'Charlotte' on all even-numbered questions and 'Lucy' on all odd-numbered questions) without paying much attention to the questions themselves. Therefore, to test whether even a subset of 4-year-olds might have systematically attributed more future knowledge to the previously accurate speaker, analyses were repeated with only those children who did not show the alternating response pattern mentioned above ($n = 9$; five males, four females). For the word category, a one-sample *t*-test revealed that children were significantly biased towards the previously accurate puppet (1.56⁄2.00; $t(8) = 3.16$, $p = .013$; $d = 1.05$). All other categories were no different from chance (all *p*s > .10).

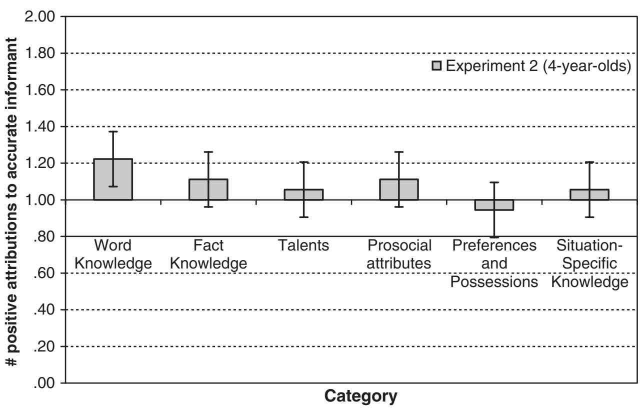

Figure 2 *Experiment 2 results.*

Discussion

The current findings reveal that even in a more simplified paradigm than the one used in Experiment 1, 4-year-olds, overall, did not explicitly attribute more future knowledge to a previously accurate informant than a previously inaccurate informant. Admittedly, the sample size is somewhat smaller than in Experiment 1; however, power analyses revealed that, given the high percentage of random responding, even doubling our sample size would likely not yield significant results: for the category with the largest effect size (word knowledge: $d = .25$), the probability of detecting an effect with $n = 36$ is approximately .31, and this probability only reaches .50 with $n = 64$.

Interestingly, s*ome* 4-year-olds did show a systematic tendency to attribute word knowledge to an informant who was previously accurate at labelling familiar objects. This was true of only a subset of 4-year-olds (50% of the sample) and even those children did not make any generalizations beyond the domain of word knowledge. Aside from the fact that this subset of children appeared to pay more attention to the specific questions, it is unclear what might have differentiated these children from their same-aged counterparts.[2] Thus, our conclusis that 5-year-olds are more apt to explicitly attribute knowledge to a previously accurate labeller than 4-year-olds. We conjecture that 4-year-olds may be more reserved in their judgments of others without more information than four instances of one's prior accuracy at labelling objects.

General discussion

The results from Experiment 1 reveal that at least by age 5 children use an individual's brief history of accuracy at labelling common objects to make explicit judgments about that individual's future word knowledge as well as broader factual knowledge. Just how broadly they expect others' knowledge to generalize remains to be tested: future research could include questions about knowledge

[2] There were no age and gender differences between the subset of children who responded randomly and those who did not (both subsets had a mean age of 4 years 6 months and an approximately equal number of boys and girls). There were also no differences in any of the counterbalancing variables (i.e. order of accurate puppet and list version).

of mathematics, geography, or car mechanics, to test the limits of children's generalizations from prior accuracy at labelling. Moreover, the present findings expand upon the research on the halo effect in children by revealing that even four instances of someone accurately or inaccurately labelling common objects is sufficient to bias 5-year-olds' impressions of that person's prosocial and antisocial attributes.

The results from the 4-year-olds suggest that they either do not make the type of explicit attributions that 5-year-olds make in Experiment 1, or only do so to a very limited extent. In Experiment 1, they show no significant tendency to make explicit attributions to the two informants; in Experiment 2, with a simplified and forced-choice procedure, a subset of them show attributions of knowledge in the same domain as the informants' prior accuracy (i.e. word knowledge), but no broader attributions. The 4-year-olds' lack of attributions is consistent with other literature on younger children's more limited tendency to attribute stable and consistent traits to individuals (e.g. Kalish, 2002; Rholes & Ruble, 1984).

The present findings have important implications regarding the development of knowledge attribution. They also have the potential to expand our understanding of children's impression formation more generally. Children often learn from informants with whom they have interacted multiple times. The current results suggest that even a few prior instances of learning are likely to influence not only children's willingness to learn, but also, at least from 5 years onwards, their preference for certain partners in activities not directly related to learning (e.g. who they wish to play with, or who they expect will share their toys with them). Adults regularly utilize others' knowledge states to infer their traits and dispositions and predict their behaviour; the present results show that such processes are at work early in life. In conclusion, the experiments reported here expand upon the current literature by providing a more detailed look at preschoolers' use and interpretation of individuals' history of accuracy and expand our understanding of how young children make trait attributions and form impressions.

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